Formulas

These are some formulas used in the exercises.

CPI

Ideal CPI

$$\begin{aligned} \text{CPI} &= \frac{\text{clock cycles}}{\text{instructions}} \\ &= \sum_{i=1}^{n} \text{CPI}_i \cdot \text{frequency}_i \end{aligned}$$

CPI with cache misses

$$\text{CPI} = \text{CPI}_{\text{id}} + \text{Memory references} \cdot \text{Miss Penalty} \cdot \text{Miss Rate}$$

Speedup between two processors

$$\begin{aligned} \text{Speedup} &= \frac{\text{Execution CPU}_1}{\text{Execution CPU}_2} \\ &= \frac{\text{IC} \cdot \text{CPI}_1}{\text{Frequency}_1} \cdot \frac{\text{Frequency}_2}{\text{IC} \cdot \text{CPI}_2} \\ &= \frac{\text{CPI}_1}{\text{CPI}_2} \cdot \frac{\text{Frequency}_2}{\text{Frequency}_1} \end{aligned}$$

Amdahl's law

$$\text{Speedup} = \frac{1}{1 - \text{Fraction} + \frac{\text{Fraction}}{\text{Speedup}}}$$